

REMARKS

Claims 1 and 5-8 are rejected under 35 U.S.C. 102(b), as being anticipated by Kumazawa et al. (U.S. Pat. 5569960). Claims 17, 20, 22, 29 and 34 are rejected under 35 U.S.C. 102(b), as being anticipated by Selna (U.S. Pat. 5741729). Claims 2-4 and 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumazawa et al. in view of Applicant Admitted Prior Art (figs. 1 and 4). Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumazawa et al. in view of Ibnabdeljalil et al. (U.S. Pat. 6365978). Claims 18-19 and 23-26 and 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Selna in view of Applicant Admitted Prior Art (figs. 1 and 4). Claims 21 and 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Selna in view of Ibnabdeljalil et al. (U.S. Pat. 6365978).

1. Correction of claim 17:

Claim 17 is objected to because of the following informalities:

In line 6 of claim 17, the phrase: "... the second bump solder pad..." should be changed to the second solder bump pad.

Appropriate correction is requirement.

Response:

Appropriate correction of claim 17 has been done as described in the above AMENDMENT TO THE CLAIMS section.

Reconsideration of the amended claim 17 is hereby requested.

2. Objection to the drawings:

5 The drawings are objected to under 37 CFR 1.83(a).
The drawings must show every feature of the invention
specified in the claims. Therefore, the limitation of
claim 17, such as: a plurality of first solder bump
pads having a first diameter; at least a second solder
10 bump pad having a second diameter greater than the first
diameter; a plurality of first solder ball pads having
a third diameter; and at least a second solder ball
pad having a second diameter greater than the third
diameter must be shown or the feature(s) canceled from
15 the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings
are required in reply to the Office action to avoid
abandonment of the application. The objection to the
20 drawings will not be held in abeyance.

Response:

In Fig.12, previously omitted features 52a, 52b,
58a, and 58b have been added and the item numbers 52
25 and 58 are deleted, as per the Examiner's suggestion.
No new matter is introduced. Allowance of the drawing
changes is hereby requested.

3. Correction of the specification:

30 For supporting the amendment of Fig.12, the
description of the omitted features 52a, 52b, 58a, and
58b is added in the specification, as specified in the

above AMENDMENTS TO THE SPECIFICATION section. Additionally, the item numbers 52a, 52b, 58 , and 58b denot the first solder bump pad 52a, the second solder bump pad 52b, the first solder ball pad 58a, and the
5 second solder ball pad 58b, respectively. No new matter is introduced in the specification. Consideration of the correction is politely requested.

4. Rejection of claims 1 and 5-8 under 35 U.S.C. 102(b):

10 Kumazawa et al. disclose a semiconductor package (fig.1, column 7, lines 12 et seq.) comprising:

a substrate 3;

a plurality of first solder pads 6a-6b positioned on a surface of the substrate, each of the first solder
15 pads having a first diameter; and

at least a second solder pad 6d positioned on a predetermined region of the substrate surface, the second solder pad having a second diameter greater than the first diameter (fig.1, column 7, lines 35-37). Since
20 Kumazawa et al. disclose all claimed structure features. Therefore, the package inherently sustains a stronger thermal stress and a stronger fatigue strength.

Regarding claim 5, Kumazawa et al. disclose the
25 substrate comprises a plastic substrate.

Regarding claim 6, since Kumazawa et al. disclose all claimed structure features. Therefore, the package inherently discloses the predetermined region
30 comprises a high stress region

Regarding claim 7, Kumazawa et al. disclose the first

solder pads are arranged in a matrix tangent region of the substrate.

Regarding claim 8, Kumazawa et al. disclose the predetermined region comprises the corners of the substrate.

Response:

First, the amended claim 1 is amended according to Figs.5-11. No new matter is introduced.

Second, the Applicant intends to point out the difference between the amended claim 1 of the present application and Kumazawa et al.'s disclosure. The amended claim 1 of the present application is repeated below:

"1. Solder pads for improving reliability of a package, the package comprising a substrate, the solder pads comprising:

a plurality of first solder pads positioned on a surface of the substrate, each of the first solder pads having a first diameter; and

at least a second solder pad positioned on a corner region of the substrate surface, the second solder pad having a second diameter greater than the first diameter to sustain a stronger thermal stress and a stronger fatigue strength."

As described in the amended claim 1 and Fig.5, a plurality of first solder pads positioned on a surface of a substrate 30, and at least a second solder pad

34 positioned on a corner region of the substrat 30. Additionally, each of the first solder pads 32 has a first diameter, and each of the second solder pads has a second diameter greater than the first diameter. That is, the solder pads of the present application have only two kinds of diameters.

However, Kumazawa et al. disclose that the pads 6 have diameters, which vary from 0.4 mm to 0.65 mm in seven stages with an increment of 0.05 mm in the direction from the center to the outer edge of the substrate 3 (col.6, lines 34-38, & Fig.2). That is, the solder pads taught by Kumazawa et al. must have at least five kinds of diameters. Therefore, the structure taught in the present application should be definitely different from that disclosed in Kumazawa et al.'s disclosure. Reconsideration of the amended claim 1 is hereby requested.

As claims 5-8 are dependent upon the amended claim 1, they should be allowed if the amended claim 1 is allowed. Reconsideration of the claims 5-8 is hereby requested.

5. Rejection of claims 17, 20, 22, 29 and 34 under 35 U.S.C. 102(b):

Selna discloses a semiconductor device (fig.1) comprising:

a substrate 4;
a plurality of first solder bump pads 8A positioned on a first surface of the substrate, each of the first solder bump pads having a first diameter;

at least a second solder bump pad 8B positioned on a first predetermined region of the first surface, the second bump solder pad having a second diameter greater than the first diameter;

5 a plurality of first solder ball pads 10A positioned on a second surface of the substrate, each of the first solder ball pads having a third diameter; and

at least a second solder ball pad 10B positioned on a second predetermined region of the second surface,
10 the second solder ball pad having a second diameter greater than the third diameter.

Regarding claim 20, since Selna discloses all claimed structure features. Therefore, the package
15 inherently comprises the first predetermined region and the second predetermined region comprise a high stress region.

Regarding claim 22, Selna discloses the first
20 predetermined region comprises the corners on the first surface of the substrate.

Regarding claim 29, Selna discloses the second predetermined region comprises the corners on the
25 second surface of the substrate.

Regarding claim 34, Selna discloses the second surface is a lower surface of the substrate, each of the first solder ball pads and the second solder ball
30 pad connecting to a solder ball 14 and using the solder ball to connect to a printed circuit board 18.

Response :

Th amended claim 17 is amended through merging the claims 27 and 34 into the claim 17. No new matter is introduced. The amended claim 17 is repeated below:

5

"17. Solder pads comprising:

a substrate;

a plurality of first solder bump pads positioned on a first surface of the substrate, each of the first
10 solder bump pads having a first diameter;

at least a second solder bump pad positioned on a first predetermined region of the first surface, the second solder bump pad having a second diameter greater than the first diameter, each of the first solder bump
15 pads and the second solder bump pad being connected to a solder bump that is connected to a chip;

a plurality of first solder ball pads positioned on a second surface of the substrate, each of the first solder ball pads having a third diameter; and

at least a second solder ball pad positioned on a second predetermined region of the second surface, the second solder ball pad having a fourth diameter greater than the third diameter, each of the first solder
20 ball pads and the second solder ball pad being connected to a solder ball that is connected to a printed circuit
25 board."

As described in the amended claim 17 and the amended Fig. 12, a chip 42 is connected to the solder bump pads
30 52a and 52b through solder bumps 54. Additionally, each of the first solder ball pads 58a and the second solder ball pads 58b is connected to one solder ball 60 that

is connected to a printed circuit board 46. Furthermore, the solder pads of the present application have only two kinds of diameters.

5 However, Selna discloses that IC 12 is connected to the upper conductive traces 8A and 8B through bonding wires 22 and 24 (col. 2, lines 3-18, & Fig. 1). Additionally, Selna also discloses that each of the conductive traces 10B and 10C is respectively connected
10 to a plurality of solder balls 14B and 14C (Fig. 1). Furthermore, Selna further discloses that a diameter of the conductive trace 10B is larger than that of the conductive trace 10C whose diameter is larger than that of the conductive trace 10A, as shown in Fig. 1. That
15 is, the lower conductive traces taught by Selna have at least three kinds of diameters. Accordingly, the structure taught in the present application should be definitely different from that disclosed in Selna's disclosure. Reconsideration of the amended claim 17
20 is hereby requested.

As claims 20, 22, and 29 are dependent upon the amended claim 17, they should be allowed if the amended claim 17 is allowed. Reconsideration of the claims 20,
25 22, and 29 is hereby requested.

6. Rejection of claims 2-4 and 9-13 under 35 U.S.C. 103(a):

Regarding to claim 9, Kumazawa et al. disclose the
30 claimed invention except for not specifically point out the predetermined region comprises the circumferences of a plurality of concentric circles

on the substrate.

AAPA (fig.4) disclose a plurality of first solder pads 14 and a plurality of second solder pads 24, the plurality of second solder pads 24 positioned on a predetermined region; wherein the predetermined region comprises the circumferences of a plurality of concentric circles on the substrate. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kumazawa et al. to prevent the package not crack easily at the corner of the chip.

Regarding to claim 2-3, AAPA (fig.1) discloses a substrate 18 comprises a plastic substrate or a ceramic substrate.

Regarding to claim 4, Kumazawa et al. disclose the substrate comprises a printed circuit board (PCB) (column 9, lines 19-20).

Regarding to claim 10, AAPA discloses the second solder pads on each of the concentric circle circumferences are arranged with an equal interval.

Regarding to claim 11, AAPA discloses the predetermined region comprises the corners of the substrate on an outside portion of a maximum circle on the substrate.

Regarding to claim 12, AAPA discloses the predetermined region comprises the circumference of

a maximum circle on the substrate.

Regarding to claim 13, it is obvious that the predetermined region comprises at least a grounded
5 solder pad.

Response:

As claims 2-4 and 9-13 are dependent upon the amended claim 1, they should be allowed if the amended claim
10 1 is allowed. Reconsideration of the claims 2-4 and 9-13 is hereby requested.

7. Rejection of claims 14-16 under 35 U.S.C. 103(a):

Kumazawa et al. fail to disclose the first and the
15 second solder pads comprise a solder bump pad, the solder bump pad connecting to a solder bump and using the solder bump to connect a chip.

Ibnabdeljalil et al. a semiconductor package (cover
20 fig.) comprising:

a substrate 63;

a plurality of solder pads on a surface of the substrate and the solder pads comprises a solder bump pad, the solder bump pad connecting to a solder bump
25 70 and using the solder bump to connect to a chip 60. It would have been obvious to one having ordinary skills in the art at the time the invention was made to modify the device of Kumazawa et al. to provide a high packaging density and direct electrical connection through bumps
30 reduces signal transmission path, as shown by Ibnabdeljalil et al.

Regarding to claim 15, it is obvious to have an underfill layer is filled in a gap between the chip and the substrate.

5 Regarding to claim 16, Ibnabdeljalil et al. disclose each of the first solder pads and the second solder pad comprise a solder ball pad, the solder ball pad 66 and 72 connecting to a solder ball 69 and using the solder ball to connect to a substrate 71.

10

Regarding to claim 16, Kumazawa et al. disclose each of the first solder pads and the second solder pad 6 comprise a solder ball pad 7 connecting to a solder ball 8 and using the solder ball to connect to a circuit board 9.

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Response:

As claims 14-16 are dependent upon the amended claim 1, they should be allowed if the amended claim 1 is allowed. Reconsideration of the claims 14-16 is hereby requested.

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8. Rejection of claims 18-19 and 23-26 and 30-33 under 35 U.S.C. 103(a):

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Regarding claims 23 and 30, Kumazawa et al. disclose the claimed invention except for not specifically point out that the predetermined region comprises the circumferences of a plurality of concentric circles on the substrate.

30

AAPA (fig.4) disclose a plurality of first pads 14 and a plurality of second pads 24, the plurality of

second pads 24 positioned on a predetermined region; wherein the predetermined region comprises the circumferences of a plurality of concentric circles on the substrate. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kumazawa et al. to prevent the package not crack easily at the corner of the chip.

10 Regarding claims 18-19, AAPA (fig.1) discloses a substrate 18 comprises a plastic substrate or a ceramic substrate.

15 Regarding claims 24 and 31, AAPA discloses the second solder bump pads on each of the concentric circle circumferences are arranged with an equal interval.

20 Regarding claims 25 and 32, AAPA discloses the first predetermined region comprises the corners of the substrate on an outside portion of a maximum circle on the first surface.

25 Regarding claims 26 and 33, AAPA discloses the first predetermined region comprises the circumference of a maximum circle on the first surface.

Response:

30 As claims 18-19, 23-26, and 30-33 are dependent upon the amended claim 17, they should be allowed if the amended claim 17 is allowed. Reconsideration of the claims 18-19, 23-26, and 30-33 is hereby requested.

9. R jecti n of claims 21 and 27-28 under 35 U.S.C.
103(a):

Regarding claim 27, Selna fails to disclose the first
and second solder pads comprise a solder bump pad, the
5 solder bump pad connecting to a solder bump and using
the solder bump to connect to a chip.

Ibnabdeljalil et al. disclose a semiconductor
package (cover fig.) comprising:

10 a substrate 63;

a plurality of solder pads on a surface of he
substrate and the solder pads comprises a solder bump
pad, the solder bump pad connecting to a solder bump
70 and using the solder bump to connect to a chip 60.
15 It would have been obvious to one having ordinary skills
in the art at the time the invention was made to modify
the device of Kumazawa et al. to provide a high packaging
density and direct electrical connection through bumps
reduces signal transmission path, as shown by
20 Ibnabdeljalil et al.

Regarding claims 21 and 28, Ibnabdeljalil et al.
disclose the first solder bump pads are arranged in
a matrix at a center region of the substrate (figs. 9-10).

25

Response:

As claims 21 and 28 are dependent upon the amended
claim 17, they should be allowed if the amended claim
17 is allowed. Reconsideration of the claims 21 and
30 28 is hereby requested.

5 Sincerely yours,

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